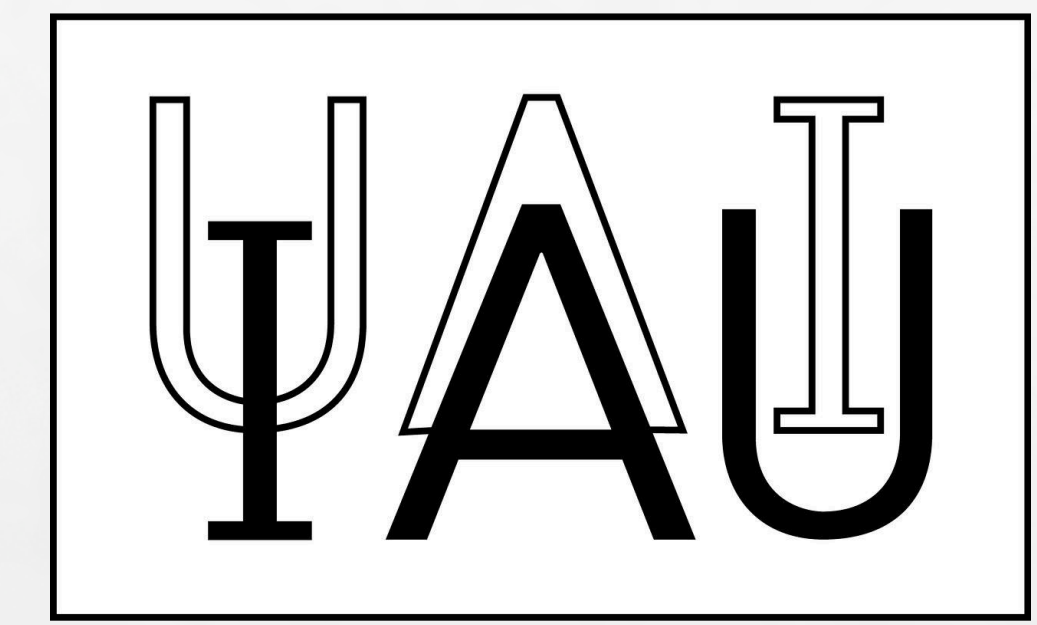




Long Term Evolution of Magnetic Field Proxies as Deduced From Archival Data

D Banerjee^{1,2}, B K Jha^{1,2}, S Mandal, S Chatterjee, M Hegde^{1,2}, A Priyadarshi^{1,2}, B Ravindra² and KoSO Digitisation Team

¹ARIES, Nainital, ²IIA, Bangalore; E-mail: dipu@iiap.res.in

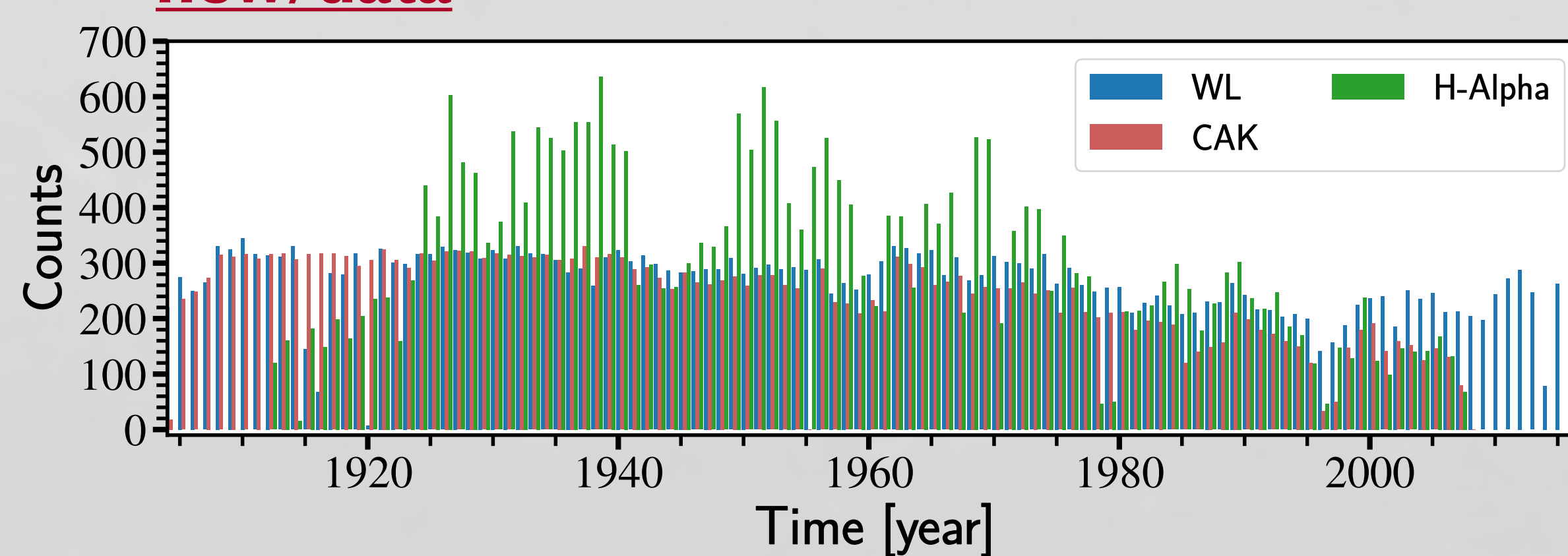


Introduction

- The **solar activity cycle** or **sunspot cycle** is the most prominent manifestation of **global solar magnetism and its variability**.
- Magnetic features** on the surface of the Sun, which act as the indirect proxies for solar magnetism, are crucial for study of long-term variability of **global solar magnetism**.

Data Archive

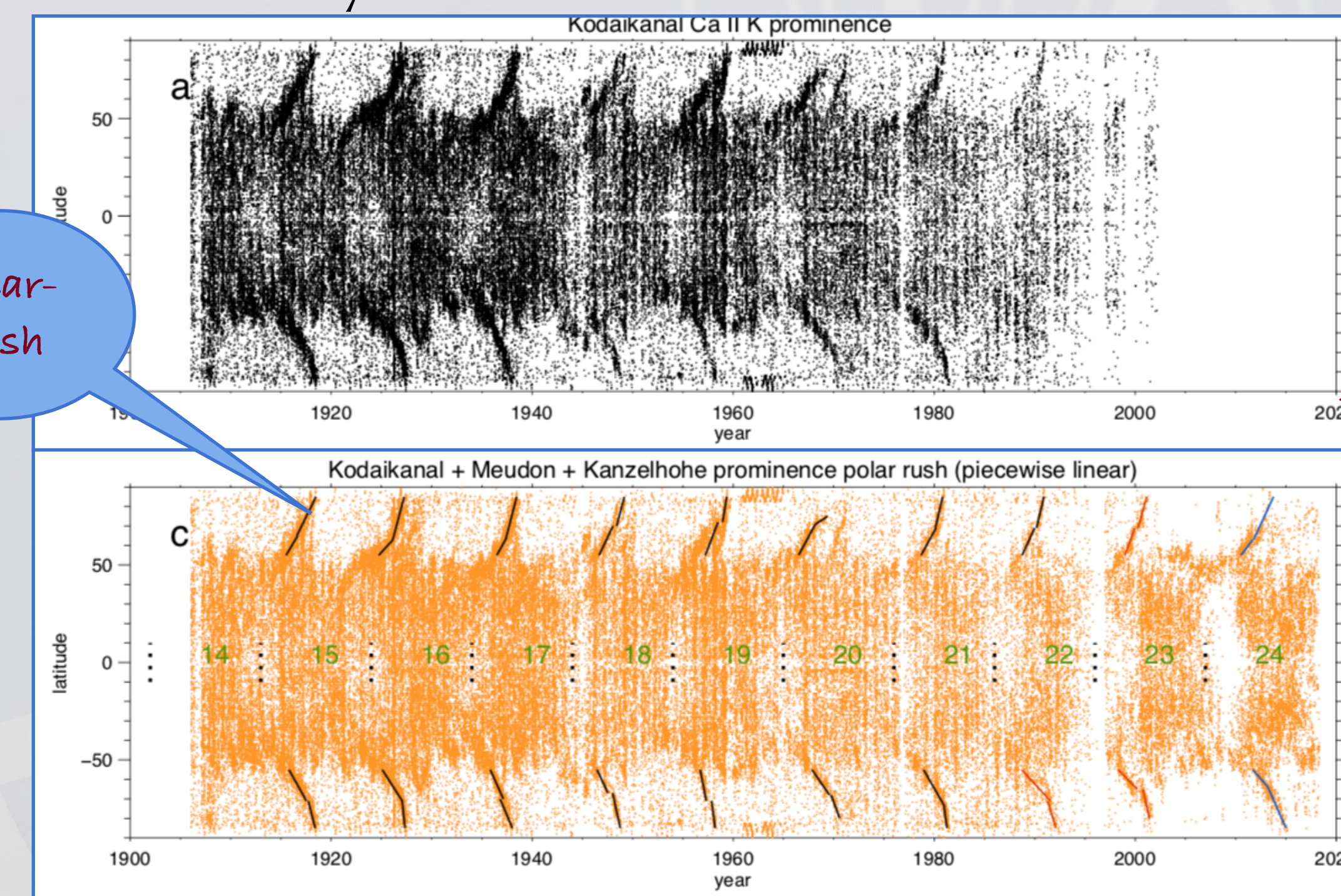
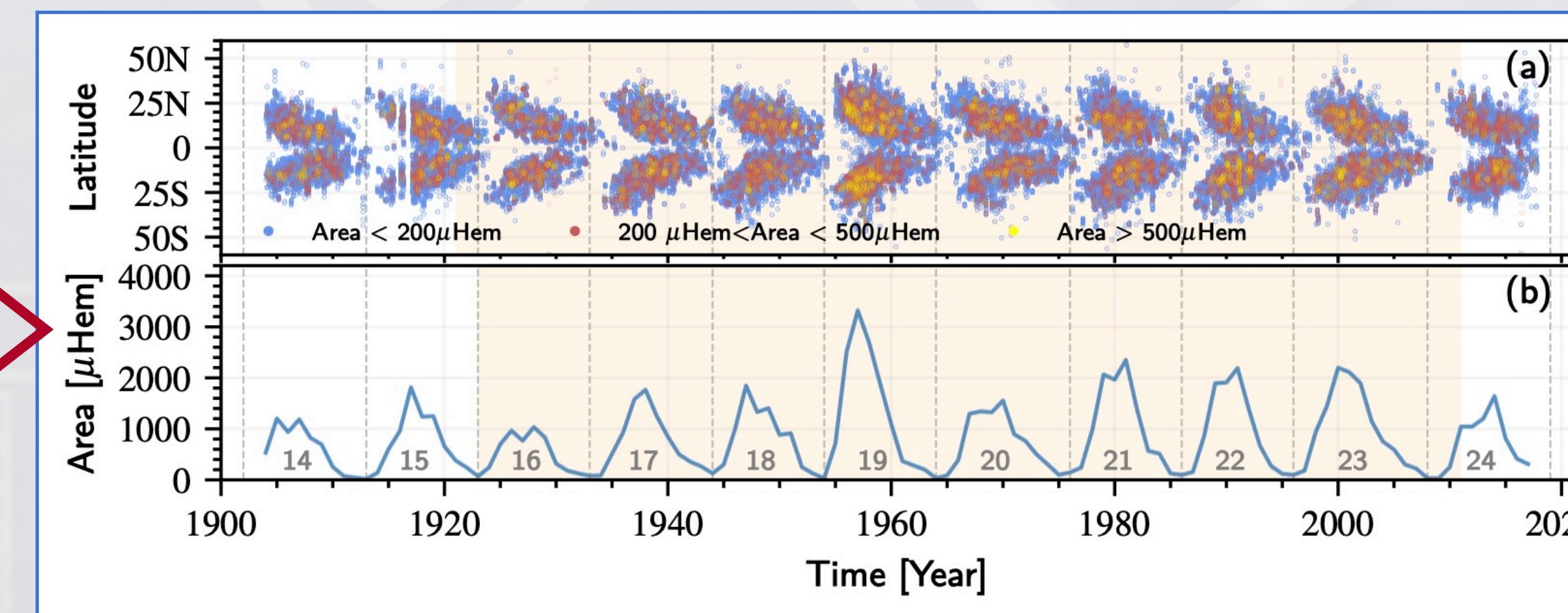
- The **Kodaikanal Solar Observatory (KoSO)** digital archive is a **unique resource** in itself, which provides **near simultaneous multi-wavelength (white-light, Ca K and H-alpha)** observations of the Sun from the **beginning of 20th century**.
- The digitised data is publicly available in 4k x4k FITS format via <https://kso.iiap.res.in/new/data>



Number of observations for each year in Multi-wavelengths.

Research Highlights from KoSO Digital Archive

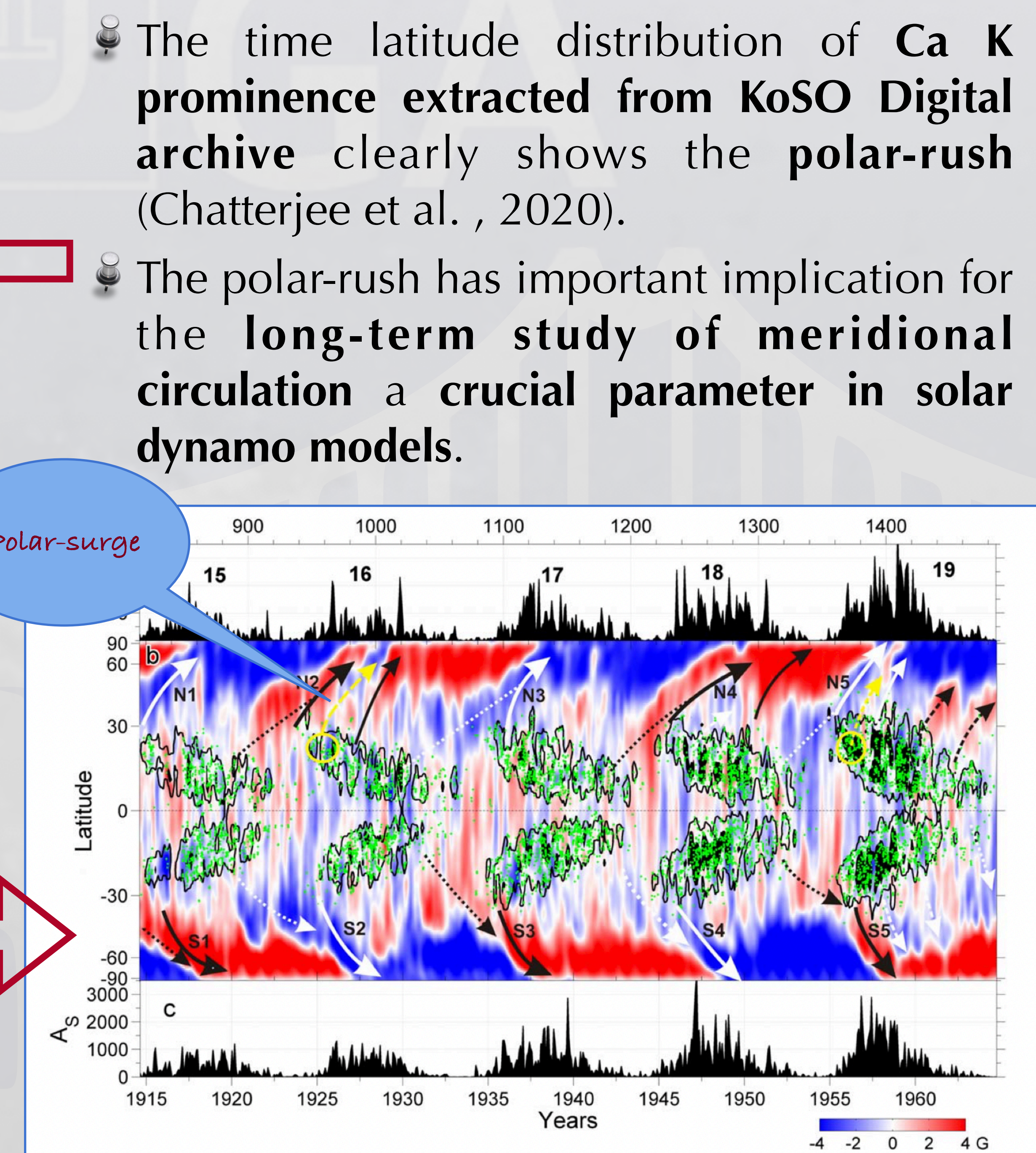
- KoSO provides the **longest (1904–2017) sunspot area series** taken from **same location and instrument** for such a long-period (Jha et al. ,2022; In preparation).
- This extended area series for 113 years will be ideal for the understanding of solar cycle variability.



Polar-rush

Polar-surge

- Combining the **Ca K and H-alpha observation** from KoSO magnetic field data has been **reconstructed for the period of 1907–1965 (Cycle-15 to Cycle-19; Mordvinov et al, 2020)**.
- Migration of poleward flux, i.e, **polar surge**, responsible for **polar field reversal**, can be clearly seen.



- The time latitude distribution of **Ca K prominence** extracted from **KoSO Digital archive** clearly shows the **polar-rush** (Chatterjee et al. , 2020).
- The polar-rush has important implication for the **long-term study of meridional circulation** a **crucial parameter** in solar dynamo models.

Conclusion

- The enormous amount of publicly available **KoSO digitised data** provides a unique opportunity to study the **long-term variability of the Sun**.
- The existing **multi-wavelengths near simultaneous observations from KoSO** make them an ideal asset for reconstruction of **pseudo-magnetogram** and **solar irradiance**.
- The various results obtained by utilising this digital archive has **expanded our understanding** of the Sun and provided crucial input to the **theoretical models**.
- KoSO also provides a **combined observation of these multi-wavelengths data** in the form of **Sun Chart** which is getting digitised currently and may be available in the future.

References

- Mandal et al. (2017); A&A
- Chatterjee et al. (2020); Earth and Space Science
- Mordvinov et al. (2022); ApJL
- Jha et al. (2022); In preparation